

## II B. Tech II Semester Supplementary Examinations, December - 2022

## STRENGTH OF MATERIALS - II

(Civil Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE Questions, each Question from each unit

All Questions carry Equal Marks

## UNIT-I

- 1 At a point  $\phi$  in an elastic material a direct tensile stress of  $70\text{N/mm}^2$  and a direct compressive stress of  $50\text{N/mm}^2$  are applied on planes at right angles to each other. If the maximum principal stress in the material is limited to  $75\text{N/mm}^2$ , find out the shear stress that may be allowed on the planes. Also, determine the magnitude and direction of the minimum principal stress and maximum shear stress. [14M]

Or

- 2 A rectangular block of  $1200\text{ mm}^2$  cross-sectional area is subjected to a longitudinal compressive load of  $1200\text{kN}$ . Determine the normal stress across the cross section of the block. If the block is cut by an oblique plane making an angle of  $40^\circ$  with normal section of the block. Determine: (i) Normal stress on the oblique plane (ii) Tangential stress along the oblique plane, and (iii) Resultant stress on the oblique plane. [14M]

## UNIT-II

- 3 A leaf spring is to be made of seven steel plates  $65\text{ mm}$  wide and  $6.5\text{ mm}$  thick. Calculate the length of the spring, so that it carries a central load of  $2.75\text{ kN}$ , the bending stress being limited to  $160\text{ MPa}$ . Also calculate the deflection at the centre of the spring. Take  $E$  for the spring material as  $200\text{ GPa}$ . [14M]

Or

- 4 a) Find the angle of twist per metre length of a hollow shaft of  $100\text{ mm}$  external diameter and  $60\text{ mm}$  internal diameter, if the shear stress is not to exceed  $35\text{ MPa}$ . Take modulus of rigidity  $G = 85\text{ GPa}$ . [7M]  
b) Write the theory of pure torsion. [7M]

## UNIT-III

- 5 a) Derive an expression for the Rankine's crippling load for a column. [7M]  
b) How will you justify the Rankine's formula is applicable for all lengths of columns, ranging from short to long columns. [7M]

Or

- 6 a) Derive the expression for crippling load when the both ends of the column are hinged. [7M]  
b) Derive the expression for crippling load when column with one end fixed and other end hinged. [7M]



## UNIT-IV

- 7 a) Explain with one example how to determine stresses in the case of chimneys. [7M]  
b) Distinguish between direct stress and bending stress by means of a diagram. [7M]

**Or**

- 8 A beam of rectangular cross section is subjected to pure bending with a moment of 20kN.m. The trace of the plane of loading is inclined at  $45^\circ$  to the YY axis of the section. Identify the N.A of the section and calculate the bending stress induced at each corner of the beam section. [14M]

## UNIT-V

- 9 a) Derive the equation of Shear center for unequal I-section. [7M]  
b) A solid circular column 20cm in diameter carries an eccentric load which produces a uniformly varying stress from zero at one edge to  $14.50\text{KN/cm}^2$  at the opposite edge. Find the eccentric load and the eccentricity. What is unsymmetrical bending? [7M]

**Or**

- 10 a) What do you mean by unsymmetrical bending? [7M]  
b) A beam of rectangular section 80mm wide and 120mm deep is subjected to a bending moment of 12kN.m. The trace of the plane of loading is inclined at  $45^\circ$  to the y-y axis of the section. Locate the natural axis of the section and calculate the maximum bending stress induced in the section. [7M]

